

**MAPLEWOOD  
ENGINEERING STANDARDS**

**City of Maplewood  
Engineering Division  
1902 County Road B East  
Maplewood, Minnesota 55109**

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## PREFACE

Complete hard copy sets of the:

1. Maplewood Engineering Standards
2. Maplewood Specifications
3. Maplewood Standard Plates

are available for \$40 (nonrefundable).

Some of these materials are also viewable on the city's website at [www.ci.maplewood.mn.us](http://www.ci.maplewood.mn.us).

The Maplewood Engineering Department will occasionally find it necessary to revise parts or pages of these standards. We will make every effort to provide each known manual holder with a copy of any future revisions.

Copies of future revisions will be made available at no additional cost within five years of the initial payment.

Manual holders should confirm the most current edition in use prior to beginning a design project in Maplewood.

Electronic copies of the Maplewood Standard Plates are **NOT** available for distribution or sale.

**SECTION 1**  
**PROCEDURES**

## SECTION 1 PROCEDURES

### 1.1 GENERAL OVERVIEW

The department of community development and the department of public works jointly administer subdivisions. The process has four main steps. First, the developer meets informally with the director of community development and city engineer to discuss the proposed plat. As a result of these meeting(s), the developer submits an application, together with cash escrow for city plat review costs, to the director of community development. The application, together with the recommendations of the city staff, are presented to the planning commission and city council at a preliminary plat public hearing by the director of community development.

The recommendations of the city staff, in part, pertain to incorporating elements of the city's comprehensive plans for storm water, sanitary sewer, water, and streets into the design of the subdivision. Water main improvements are administered by the St. Paul Regional Water Services. The developer shall provide or improve ponding areas and trunk storm sewers required to adequately serve ultimate development of the drainage area that the subdivision is located within. The developer shall construct trunk sanitary sewers of sufficient size AND depth as necessary to serve future subdivisions in the same drainage area. Trunk water mains shall be provided as required to develop the capacity of the water distribution system.

Streets and utilities shall be extended to the plat boundary to provide service to future subdivisions. Street names shall be approved by staff prior to submittal of preliminary plat to council. Collector streets are to be constructed when required in the comprehensive plan. In certain cases, off-site improvements are required to adequately serve a proposed subdivision. The city will not, except in special cases, provide financial assistance to the developer to pay for these items. The preliminary plat conditions adopted by the city council are used as the basis of a developer's agreement.

#### **Public vs. Private Construction**

##### **Public**

Generally the city's policy is that ALL public infrastructure will be designed, contracted and the construction administered by the Maplewood Engineering Department through the MN Statute 429 Public Improvement Process. The developer shall petition the city for these public improvements with the costs of such improvements being assessed back to the developer. Sureties to the city are governed through a developer's agreement.

##### **Private**

The city engineer may, under special consideration, allow the developer to privately construct public infrastructure through a developer's agreement. The developer **MUST** provide a written request to the city engineer, outlining in specific detail how they will address the conditions below and the construction inspection requirements in Section 1.3. Said written request will be considered by the city engineer and made part of a developer's agreement if the consideration is to be allowed.

The developer retains a consulting engineer to develop plans and specifications conforming to these standards, sound engineering judgment, and the preliminary plat conditions. After approval of the plans, the developer's engineer is responsible to acquire all required permits from other regulatory agencies. The developer shall pay the city the outstanding balance of all costs for city and water utility review not covered by the cash escrow deposited at the time of preliminary plat application. The developer's agreement commits the developer to build the subdivision in accordance with the approved plans and comply with the council preliminary plat conditions. The developer agrees to make monthly payments of all costs incurred by the city. The developer must pay any applicable cash connection fees or deferred assessments at the time of preliminary plat approval. The city agrees to accept the subdivision after its successful completion.

A preconstruction conference is to be scheduled after the developer's agreement is executed and the developer has provided evidence of required minimum insurance policies, and prior to beginning of construction. The developer's engineer shall also submit the qualifications of those individuals proposed to serve as construction inspectors. The city reserves the right to accept or reject individuals and/or firms for the construction inspection function.

During the construction phase, the city and the St. Paul Regional Water Services will, in a general way, monitor the progress. The developer **pays the city** for these incurred costs. If it is apparent that the work is in conformance with requirements, then these inspections will be minimized. If there are problems, the city's and utility's involvement and cost will be proportionately greater.

All work must be accepted except for bituminous wear course or covered by an escrow before final plat will be approved. The developer and engineer must submit lien waivers, **as-built drawings**, test results, and certification of conformance with plans and specifications prior to final plat. The developer must pay all outstanding costs to the city and provide an escrow equal to 150 percent of the unpaid costs prior to final plat to ensure satisfactory completion.

## 1.2 PRELIMINARY PLAT

Any conditions determined by the council after preliminary plat public hearing are made part of the plat requirements. Refer to Environmental Protection and Critical Area and Subdivision ordinances.

## 1.3 CONSTRUCTION INSPECTION

The city allows the developer to hire an independent consulting engineering firm to provide for construction inspection. ***In no case shall the construction inspector or firm have a business interest in the subdivision.*** The construction inspector must be present during all construction according to the project inspection schedule and/or as conditions warrant.

PROJECT INSPECTION SCHEDULE		
Phase	Type	Frequency
1	Erosion control and construction zone fencing	Occasional spot check
2	Grading and turf restoration	Occasional spot checks
3	Utility (sanitary sewer and water)	Full time
4	Services	Full time
5	Storm sewer	Full time
6	Street Grading Tolerance Compaction Curb and gutter/sidewalk Raise iron Paving/driveways	Occasional Full time Full time Full time Schedule/full time Full time
7	Testing	Schedule/full time

The written qualifications (résumé) of each proposed inspector shall be presented prior to scheduling the preconstruction conference. No individual shall serve as the inspector other than those having prior approval of the city.

The inspector shall have one of the following minimum qualifications:

1. Graduate of a two-year program in civil technology from an accredited school with two years of construction inspection experience; or



2. Technician with eight years of construction inspection experience; or
3. Engineer-in-training with one year of construction inspection experience; or
4. Registered Professional Engineer.

The inspector is to be distinct from the construction staking crew.

Prior to utility construction, all block corner and point of curvature irons shall be in place, protected with guard stakes. The inspector shall verify staking relative to these irons. During construction, copies of cut sheets shall be provided to the city upon request.

The inspector is not merely a passive observer or representative. The inspector shall take positive steps to identify and correct instances where the contractor has failed in his responsibilities to protect public safety, follow all applicable laws, and provide quality work in conformance with the specifications. If work not in conformance with the plans and specifications is being performed, the inspector is to immediately inform the contractor. Should the contractor fail to make corrections, then the inspector shall promptly notify the city engineering department.

If the contractor is not following applicable laws (e.g., work before or after noise ordinance limits, trespass on private property) or has jeopardized public safety (e.g., inadequate traffic control), then the contractor shall be directed to immediately correct the situation. If the contractor does not immediately correct the situation, then the inspector shall direct the contractor to stop work and notify the city engineering department.

The city has the right under the subdivision agreement to stop work on the project. Work will be suspended until corrective measures have been completed to rectify the problem(s), and may be suspended for an additional specified period in cases where public safety has been compromised or laws have not been followed. After a stop-work order has been issued by the city, the contractor shall not resume operations until approval has been given by the city.

If the inspector repeatedly fails to identify problems and notify the city, then the city may direct that the inspector be replaced. Repeated failure to positively respond to problems may be a basis to deny approval of the firm for inspection of other subdivisions.

**SECTION 2**

**REQUIRED SUBMITTALS**

## SECTION 2 REQUIRED SUBMITTALS

### 2.1 STORM SEWER CALCULATIONS

Provide a copy of the grading plan with drainage area divisions shown. The area tributary to each set of catch basins shall be shown. It should be confirmed that the capacity of the catch basin inlets is adequate for the 10-year storm runoff. Accompanying the drainage map shall be standard rational method calculations. The calculations shall be on a form sheet or a Lotus spreadsheet or similar. Structure numbers on the calculations shall be the same as those used on the plans. **Pond number system shall comply with approved *Maplewood Storm Water Management Plan*.**

If the subdivision has a regional ponding area, then the drainage map shall include all tributary area. A copy of the city's aerial orthophoto maps is available for this purpose. Electronic Lydar data may be available at a later date and for a price yet to be determined. The fee for orthophotos is \$10 an acre (0.4 ha). **A copy of TR-55 or HydroCAD storm routing model must be submitted.** Use of triangular hydrography or other manual methods is unacceptable.

### 2.2 STANDARD PLANS

In order to standardize construction plans and record drawings within the city, the guidelines listed below shall be followed. The plans shall consist of title sheet, details, street/storm sewer, utility, grading/erosion control drawings, tree plan, and proposed plat drawing.

1. The city standard title sheet with an index indicating the sheet number and title of each sheet within the set of plans shall be required. The city project number shall be given on each sheet.
2. Submittals of as-builts and plats shall be clearly legible hard copy drawings as well as electronic submittals in a format compatible with AutoCAD (i.e., .dxf .dwg). Electronically scanned raster images may be submitted where plans have been hand drafted. **The as-built plans should be supplied within 120 days after final utility acceptance along with a copy of the proposed final plat drawing.** A copy of the final plat shall be submitted within 30 days of the recordation of the final plat. At least two points within the subdivision will be identified with their Ramsey County plane coordinates on the hard copy.
3. Preferred sheet size shall be 22" by 34" (560 mm by 865 mm). On non-state aid projects 24" x 36" (610 mm x 915 mm) would be acceptable.
4. Scale shall be shown on the plans as follows:
  - a. Horizontal: 1" = 30' or 1" = 50' or (1:500)
  - b. Vertical scale: 1" = 5' or 1" = 10' or (1:50)
5. A standard title block shall be placed on the bottom or right side of each sheet.
6. All detail drawings shall be on one or more separate sheets in the plans and specifications.
7. The profile shall be directly below the plan with the stationing aligned as closely as practical. Stationing shall be shown on the plan view as well as on the profile. Stationing for all utilities shall be consistent with that used for street design.
8. All parcels shall be properly labeled with lot and block numbers and plat name or parcel numbers in unplatted areas. Developed parcels shall have their addresses shown on the plan.
9. All streets shall be clearly and correctly labeled.

10. All match-line breaks shall be clean with referenced points clearly marked. All plans that are broken by a match line shall be on the same or consecutive sheets with reference made to the continuation on another sheet (e.g., see Sheet 10).
11. Existing utilities shall be shown in dashed lines, stationed and labeled as existing.
12. Approximate location of existing franchised utilities, such as cable, gas, electric, and telephone, as well as private utilities, such as yard light and lawn irrigation systems, shall be shown. Final location of new utilities shall be clearly shown on the as-built drawings.
13. Soil boring locations shall be shown on the plans. Indicate water table elevations and soil types in profile at boring location.
14. Right-of-way and curb and gutter back-to-back/face-to-face widths shall be shown.
15. All plans shall have properly placed north arrows for each plan on the sheet.
16. Bench marks shall be placed on all plan and profile sheets.
17. All horizontal and vertical curve data shall be shown.
18. Stationing of sanitary sewer services shall be indicated on the construction sheet behind the right-of-way line. The service station, as measured from the nearest downstream manhole, shall be indicated by an "S" in front of the stationing. If the main line station and right-of-way line station are not the same (i.e., angled services, etc.), both will be shown. Constructed locations to be shown correctly on as-built drawing.
19. The invert elevation of all sanitary sewer services at the property line shall be shown on the plans. If risers are placed, the height of each shall be indicated and each shall be drawn on the profile view. Correct elevations and stationing shall be shown on as-builts.
20. All manholes shall be numbered on both plan and profile.
21. Water services shall be located at least 2' (0.6 m) upstream of sanitary sewer services in all new subdivisions. Stationing of water corporations shall be measured from the downstream sanitary sewer manhole. If no sanitary sewer is present, stationing shall be based on the street stationing. Water service stations shall be indicated by a "W" in front of the stationing. If the service is angled, the tail end station shall also be shown. Correct stationing is to be shown on as-builts. Provide ties for valves, hydrants, and curb-stop boxes in a data-sheet format according to Maplewood Specification MW-2504, Water Main Systems.
22. All water valves, fittings, and deflection points shall be identified with street station and center line offset on construction plans. Said improvements shall be shown on as-builts with reference to fire hydrants and/or downstream sanitary sewer manholes.
23. All permanent easements and rights of entry shall be shown and labeled including standard drainage and utility easements containing public facilities. All wetland buffer zone easements shall be shown.
24. All sewer and water main shall be shown in profile with the appropriate information such as size, material, grades, and invert elevations. Any utility crossings shall be shown on the profile. Indicate any substandard clearance as defined in the utilities specifications.
25. A structure schedule for all storm sewer and sanitary sewer structures shall be provided. It shall identify applicable structure location, diameter, build height, invert elevations, casting type, excess excavated materials, etc., as well as pipe diameters, class and length.

26. Separate grading, erosion control (as approved by the watershed district) and tree preservation plans, as required, shall be incorporated in the plans and specifications.
27. Identify by number and date and explain all plan changes in a revision block.

### 2.3 INSURANCE

The owner's (developer's) contractor shall take out and maintain during the life of the contract the following types and minimum amounts of insurance as indicated in the specifications. In any case where work is sublet, the contractor shall require each subcontractor to insure himself in like manner and provide the city with proof of this insurance.

INSURANCE REQUIREMENTS	
Worker's compensation	Statutory requirements
Comprehensive public liability Bodily injury or death Property damage	\$1,000,000 per person \$1,000,000 per occurrence
Automobile Bodily injury or death Property damage	\$300,00 per person and \$750,000 per accident \$100,000 each occurrence of \$500,000 combined single limit

The comprehensive public liability policy shall cover claims that arise from explosion, collapse, and damage to underground facilities. The contractor shall either have the City of Maplewood as joint insured party under the comprehensive public liability policy or shall provide an owner's protective contingent liability insurance policy with the City of Maplewood as the insured party. The limits of the owner's protective contingent liability policy shall be at least the minimum specified for comprehensive public liability. A copy of all required insurance must be delivered to the city prior to scheduling of the preconstruction conference. The description of the work covered by the insurance shall be specific as to city project number and subdivision name.

### 2.4 SOIL BORINGS

Soil borings taken by an independent geotechnical testing company within the project limits are required. There shall be a boring to 3' (0.9 m) below invert depth of lowest pipe every 500' (150 m) along street centerline. The moisture content of the soils at 5' (1.5 m) below finished grade shall be measured at each boring. This is to be compared with optimum moisture density typical of those types of soil.

A soil exploration report will be bound to the specifications. The report shall identify soil types, penetration counts, water level, and in-place moisture content relative to optimum.

### 2.5 OFF-SITE EASEMENTS

If the project includes work beyond the right of way or plat limits, then executed easements must be submitted before the preconstruction conference is scheduled or grading permit is issued.

### 2.6 CERTIFICATE OF COMPLIANCE

Certificates of compliance are required as defined by Maplewood Specification MW-2021.2A1c.

## 2.7 TESTING

The tests and minimum frequency that shall be provided include, but are not limited to, the following table:

TESTS AND FREQUENCY	
Test	Minimum Frequency
Trench backfill compaction	1 per 3 MH at 4' (1.2 m) and 6' (1.8 m) depths in trench (sanitary sewer)
Trench backfill compaction	1 per 800' (240 m) at 4' (1.2 m) and 6' (1.8 m) depths in trench (water main)
Trench backfill compaction	1 per 3 structures at 4' (1.2 m) depth in trench (storm sewer)
Subgrade compaction	1 per 500' (150 m) of street at 2' (0.6 m) depth if undisturbed. 1 per 5 utility conduit crossings.
String line	All streets - subgrade
(Select) granular borrow gradation	1 per source or as directed by the city engineer
Roll test & string line	All streets—(select) granular borrow
In-place aggregate gradation	1 per 1000' (300 m) of street; greater frequency may be required if recycled materials are utilized
Aggregate base compaction—nuclear density	1 per 1000' (300 m) of street
Roll test & string line	All streets—aggregate base @ 50' (15 m) intervals
Bituminous mixture asphalt content and aggregate gradation	1 per 500 tons (455 metric tons)
Bituminous material compaction	Reference chart in Maplewood MW-2340.3H2
Compressive strength of dry-cast segmental masonry retaining wall units	1 sample of 8 blocks per type for each 10,000 units or fraction thereof
Concrete cylinder test	1 set of 3 cylinders per 50 cubic yards (38 m <sup>3</sup> ) of concrete for curb and gutter (minimum 2 sets per day) 1 set of 3 cylinders per 50 cubic yards (38 m <sup>3</sup> ) of concrete for driveway or sidewalk (minimum 1 set each day)
Concrete air entrainment and slump	As required to confirm, tests performed by independent tester
Water main pressure test	All new water main
Leakage	All new water main
Electrical conductivity	All new water main
Residual chlorine	All new water main
Bacteriological	All new water main and existing water main requiring rechlorination

Mandrel test	All PVC sanitary sewer main and HDPE storm sewer within the street
Air pressure test	All PVC or DIP sanitary sewer mains and services
Television inspection	All existing sanitary sewer within project limits at completion of manhole adjustment following bituminous base. All new sanitary sewer at completion of project.
Vacuum test	All new sanitary sewer manholes subject to groundwater conditions.
Nutrient analysis (select) of topsoil borrow	1 test per source at least one month prior to use and one test of materials delivered on site. Additional test(s) may be required if material delivered deviates from the pre-tested prospective source.

Reference Maplewood Specification SC-1603.4 for acceptance and re-testing requirements.

Test samples and locations shall be selected or approved by the city engineer. These samples shall be delivered to an independent testing laboratory as soon as practicable. Should any of the specified tests fail to meet the requirements of the specifications, the contractor shall perform corrective work and take additional tests as may be required to satisfy the city engineer that the specified test requirements have been met. Copies of test results are to be supplied to the developer's engineer, contractor, and the city engineering department.

Copies of delivery tickets or invoices for select granular borrow for trench bedding, mulch, and seed may be required to be supplied to the city engineering department. On a weekly basis, or as requested, a copy of the inspector's notes shall be furnished to the city. The inspector is expected to make a full record of observations.

## 2.8 PONDING AREA REQUIREMENTS

Prior to final plat, the developer may be required to arrange and pay for a survey of any ponding area developed as part of the plat. The engineer shall submit a stage-storage computation for the pond as built. The stage-storage shall be measured by one-foot vertical increments. This data will be used to confirm storm water modeling. If applicable, recordable buffer-zone easements shall be submitted to the city for recordation with the plat.

## 2.9 FIRE HYDRANT

The as built shall give the finished elevation of each fire hydrant operating nut for future benchmark purposes. **A copy of survey notes of the level loop shall be submitted.**

An inspection will be made to insure that threads on hydrant caps are not damaged. Specified ground clearance of safety flange and nozzles will be verified. The adequacy of field repainting and placement of hydrant marker will also be confirmed at this time.

## 2.10 FINAL INSPECTION

The contractor, developer's engineer, inspector, and city representative shall jointly inspect the project prior to final acceptance. This shall be scheduled after the contractor and developer's engineer and inspector have previously gone through the system and determined that all aspects are acceptable. A copy of the field inspection report of necessary corrections shall be given to the city prior to final acceptance inspection. Particular attention will be paid to turf establishment, removal of all temporary erosion control measures, storm sewer structure inspection, lamping of

storm sewer lines, and check of riprap, pipe ties, and removal of the bottom row of bars from the trash guard at flared-end sections. If a final inspection is required to be repeated, the cost of the city's staff time shall be incurred by the developer.



**SECTION 3**  
**CONTROL OF WORK**  
**AND GRADING**

## **SECTION 3 CONTROL OF WORK AND GRADING**

### **3.1 REFERENCES**

*Maplewood Code of Ordinances*

*Ramsey County Erosion and Sediment Control Handbook*, Ramsey Soil and Water Conservation District

*Protecting Water Quality in Urban Areas*, Minnesota Pollution Control Agency

*Minnesota Manual of Uniform Traffic Control Devices*, Field Manual (latest edition), "Temporary Traffic Control Zone Layouts," Minnesota Department of Transportation

*Uniform Building Code*

### **3.2 SECURE SITE**

As stated in Section 9-193 (5) f. of *The Code of Ordinances*, City of Maplewood, it is required that all trees to be saved shall be protected by orange construction fencing installed before any grading begins.

It is required that the perimeter of the subdivision be fenced before any grading begins. Existing lot corner irons shall be located and marked with guard stakes at this time. Unless the city and affected property owners are notified that a corner iron cannot be found prior to any grading, then it will be presumed to have been lost due to the construction of the subdivision and shall be replaced by a RLS at the developer's expense.

Refer to Maplewood Standard Plate 350 for construction details of required erosion control.

All of the contractor's equipment and supplies must be stored within the fenced perimeter of the subdivision. As given in Maplewood's *The Code of Ordinances*, Section 19-9 (8), it is a public nuisance to leave an excavation open when work is not in progress. All excavations within the subdivision shall be backfilled at the end of the workday or be properly fenced. All manholes shall be securely plated when not in use.

Reference for erosion control measures should be made to *Ramsey County Erosion and Sediment Control Handbook*. Directives from a representative of the watershed district or engineering department concerning maintenance of or need for additional erosion control measures shall be promptly implemented.

### **3.3 WORK HOURS**

The hours of work are limited to 7 a.m. to 7 p.m., Monday through Saturday according to Maplewood's *The Code of Ordinances*, Section 19-48, except for emergency situations, or with specific written authorization of the city engineer. No engines or power equipment shall be started, warmed up, or otherwise operated at other times. Material or equipment deliveries must be made within these specified work hours.

### **3.4 TRAFFIC CONTROL**

When it is necessary to work in an existing traveled public right-of-way, traffic control requirements shall be addressed in the project special conditions. Traffic control shall be the responsibility of the

contractor. The contractor shall provide the developer and the city with a traffic control plan outlining the traffic control for each phase of construction. The traffic control plan shall be approved by the city engineer prior to construction and shall be based on the current edition of "Field Manual" of the *Minnesota Manual of Uniform Traffic Control Devices*.

A specific drawing that accounts for driveways, intersections, and other pertinent factors at the actual site shall be developed. The use of unmodified standard drawings that do not account for site specific factors are unacceptable. The developer's engineer will have to exercise judgment to adopt standard criteria to the specific site. The use of text only in the plans is unacceptable. For work on county or state roadways, the traffic control plans shall be submitted and approved by the controlling authority.

Since it may be necessary to modify traffic control to suit actual weather conditions and other contingencies, the inspector and contractor shall each have the current edition of the Field Manual "Temporary Traffic Control Zone Layouts" in their immediate possession. Although the inspector and contractor should try to notify and receive the approval of the city engineering department, it is the contractor's responsibility to continuously modify the traffic control to provide a safe work zone. Modifications to the traffic control plan shall be consistent with the Field Manual and prudent judgment. Deviations to the traffic control plan that are made without approval or specific cause are prohibited.

The contractor shall notify the Maplewood Public Safety Department prior to commencing any construction that will restrict traffic on a traveled roadway, and shall again notify when fully reopening the roadway to traffic. The contractor must provide for emergency police and fire access to all properties at all times. Other notifications, as outlined in Maplewood Specification MW-2021, Mobilization, will be defined at the preconstruction meeting.

The contractor shall be responsible for the immediate repair or replacement of all traffic control devices that become damaged, are moved, or are destroyed; of all lights that cease to function properly; and of all barricade weights that are damaged, destroyed, or otherwise fail to stabilize the barricades. The maintenance of the traffic devices shall be the responsibility of the contractor and shall be checked at least twice daily, including once at the end of the work day for proper alignment, proper visibility, and retroreflectivity. This responsibility includes nights, weekends and holidays. The check shall include immediate correction of deficiencies. A checklist form for daily inspection of traffic control devices, as required, is available at the Maplewood Public Works Department. At the preconstruction conference, the contractor shall furnish names, addresses, and telephone numbers of at least three individuals that have the authority and ability to implement repairs as necessary.

All flaggers shall be equipped with and wear approved safety clothing. Flaggers shall have and use a legible **STOP - SLOW** paddle for controlling traffic.

Abrupt transitions between a temporary driving surface and a manhole rim or adjacent pavement shall not exceed 1.5" (38 mm). If a greater difference exists, then ramping of the adjacent structure or traffic control devices shall be provided subject to the approval of the engineer.

### 3.5 GRADING PLAN

The grading plan shall incorporate the following data as a minimum:

1. Title block on lower edge or right side. The subdivision name and city project number shall be identified. The plan size shall be the same as the street and utility drawings, i.e., 22" by 34" (560 mm by 865 mm). The scale shall be 1" = 50' or 1" = 30' or (1:500).
2. Show and label existing right-of-way, easements, and property lines. All existing corner irons on plat perimeter shall be shown.

3. Show and label proposed right-of-way and property lines; all easements other than standard drainage and utility easements (e.g., 5' [1.5 m] side and 10' [3.0 m] front and rear); and all proposed ponding easements. Show block and lot numbers.
4. Existing contour lines at a maximum of 2' (0.5 m) increments. Lines shall be drawn as a light solid line. Labeling of even 10' (2 m) contours in staggered locations at no more than 4" (100 mm) along their drawing length. Additional labeling of even contours is required in exceptionally flat areas.
5. Proposed contours at a maximum of 2' (0.5 m) increments. Lines should be a heavy solid line. The point of intersection between the existing and proposed contour lines is to be indicated by tick mark or circle.
6. Construction limits drawn as a very heavy or special line. This is where orange construction fencing shall be erected.
7. Any borrow areas where the grade is to be restored to existing shall be shaded. These borrow areas shall be within the construction limits.
8. Show silt fences, entrance pads, right-of-way diversions, and wood-fiber blanket areas in accordance with the criteria given in Maplewood Standard Plate 350.
9. Drainage around house pads shall be shown with arrows consistent with the contours shown.
10. Show curb and gutter of proposed streets.
11. Show house pad location with minimum setbacks. Denote style of house as RAMB (rambler), SEWO (split entry walkout), or FBWO (full basement walkout). The use of SEWO requires at least 3' (0.9 m) of elevation drop from front to rear of house pad. The use of FBWO requires at least 7' (2.1 m) of elevation drop from the front to rear of the house pad.
12. Show garage slab elevation of each house. Garage slab is to be between 3.6' (1.1 m) and 1.2' (0.4 m) higher than street centerline elevation. Proposed street grade design (center line spot elevations and grades) shall be shown as a check for driveway profiles.
13. Show the elevation of the basement slab. For SEWO and FBWO the basement elevation is the ground level at the walkout plus 0.5' (0.2 m). For RAMB the basement level is a minimum of 7' (2.1 m) below garage slab elevation unless the sanitary sewer is too shallow. All basement floor elevations shall be at least 4.5' (1.4 m) above the top of the sanitary sewer main. All basements of structures adjacent to storm water ponds shall be at least 2' (0.6 m) above the 100-year high water elevation.
14. The grading plan shall be designed so that the runoff from each lot is conveyed through swales in drainage and utility easements out onto the right-of-way, to an inlet structure, or to a ponding area. Drainage along back-yard swales should not extend long distances without a storm sewer inlet drain, and check dam (if the drainage swale continues in the same direction).
15. Sheet drainage from one lot through another is not acceptable. Drainage from the subdivision flowing off site is not allowed except for minor undisturbed areas with elevations that reasonably preclude them from being drained internally.
16. All slopes shall be three horizontal to one vertical or less. Slopes that are steeper than 4:1 or carry concentrated flow require installation of wood-fiber blanket for restoration.
17. All grading necessary to create house pads shown on the grading plan is to be done as part of the street and utility construction. Phased grading of the right-of-way and subsequent grading of lot with building permit is not acceptable. If the homebuilder desires to further change the

grading beyond that shown on the approved grading plan, this may be done only with the approval of the city engineer.

18. Soil boring locations shall be shown.

### **3.6 EROSION CONTROL PLAN**

The erosion control plan submitted to the city shall be based on the construction limits shown on the approved grading plan. The plan shall be in compliance with the City of Maplewood Ordinance 722 requiring erosion and sediment control for land disturbance activity within the city.

The plan shall be prepared in accordance with the *Ramsey County Erosion and Sediment Control Handbook*. The handbook provides guidelines for plan preparation, criteria for erosion and sedimentation control, procedures for plan preparation, minimum plan contents, and supporting data. A copy of this plan is available for \$25 from the Ramsey County Soil and Water Conservation District at 2015 Rice Street North, Roseville, Minnesota 55113. Contact Director Tom Peterson at 488-1476 for assistance.

A permit shall be applied for with the Metropolitan Pollution Control Agency. The NPDES log shall be kept on the site in a conspicuous location.

### **3.7 TREE PLAN**

The tree inventory plan to be submitted to the department of community development shall be based on the construction limits shown on the approved grading plan. The construction limits are to be transposed to a survey of trees. A tabulation of trees by type remaining outside the construction limits compared to those removed inside the construction limits is to be made. It is assumed that all trees within the construction limits are lost unless they are identified on the grading plan encircled with orange construction fence. Orange construction fencing for protecting trees shall be 5' (1.5 m) outside of the drip line of the trees in order to consider the tree as secure from construction.

### **3.8 RETAINING WALLS**

Refer to Maplewood Specification MW-2411, Modular Precast Concrete Block Retaining Wall.

The developer shall install as part of the street and utility construction all necessary retaining walls shown on the approved grading plan. The base of retaining walls are to be set 0.5' (0.2 m) inside of the property line of the uphill property. Walls shall be placed such that the geogrid reinforcement is on the same property as the wall.

All retaining walls shall be of modular precast concrete unit design. The use of timber retaining walls is not acceptable. Concrete retaining wall units shall be Keystone, Diamond, Aztech, or an approved equal.

All walls shall be provided with an approved aggregate footing. Geogrid shall be used to provide reinforcement as required. The design of the retaining walls shall be shown with the grading plan. Walls shall be designed by a structural engineer who is a Registered Professional Engineer. Walls in excess of 48" (1200 mm) must be approved by the building official prior to construction, as they require a separate building permit.

Walls with over 30" (750 mm) of exposed height may require fencing according to the *Uniform Building Code*. Fence posts shall be driven, not augured, to prevent damage to geogrid.

### **3.9 RESTORATION OF PONDING AREAS**

Refer to Section 5.6 of these guidelines.

### **3.10 TURF ESTABLISHMENT**

Refer to Maplewood Specification MW-2575, Turf Establishment.

**SECTION 4**

**STREET DESIGN**

## **SECTION 4 STREET DESIGN**

### **4.1 REFERENCES**

*Guidelines for Residential Street Design, A Recommended Practice*, Institute of Transportation Engineers

*Road Design Manual*, Minnesota Department of Transportation (Mn/DOT)

*Guide for Development of New Bicycle Facilities*, AASHTO

*Minnesota Bicycle Transportation Planning and Design Guidelines*, Mn/DOT

*Minnesota Department of Transportation Standard Specifications for Construction*, 2000 Edition

*Maplewood Specifications* (MW)

### **4.2 MAXIMUM/MINIMUM GRADES**

Maximum street grade--8%

Minimum street grade--0.5%

Driveways shall drain to street. Minimum driveway grade is 1%. Recommended driveway grades are 2% to 8%. Maximum driveway grade is 13% for commercial or residential properties. For urban designs, boulevards shall also drain to the street. Typical grade of 2% to 4% shall extend a minimum of 4' (1.2 m) beyond the curb and gutter. Slopes beyond boulevards shall be a maximum of 3:1 (horizontal:vertical).

### **4.3 VERTICAL CURVES**

The minimum length of vertical curves required for local streets is calculated using the following equation:

$$\text{Length} = K \times (\text{Grade 2} - \text{Grade 1}), \begin{matrix} (K=24 \text{ sag}) \\ (K=17 \text{ crest}) \end{matrix}$$

The formula applies to both sag and crest vertical curves. The formula is based on ITE recommended 25 mph (40 km/h) design for local streets in rolling terrain.

Vertical curves for collector streets shall follow the procedure of the Mn/DOT *Road Design Manual*. The minimum vertical curve length is 50' (15 m), unless  $M < 0.1$  foot (0.03 m) in which case a grade break may be used.

### **4.4 INTERSECTION LANDINGS**

The grade of the branch street on a tee intersection, or the street of lesser priority when intersecting with a collector or arterial, shall be limited to 2% to provide a landing area. The landing area shall extend from the gutter line (extension) of the through or higher priority street back a minimum of 75' (23 m).

### **4.5 INTERSECTION DESIGN**

Skewed intersections are not allowed. The minimum centerline-to-centerline distance between intersecting branch streets is 150' (45 m). A 30' x 30' (9.1 m x 9.1 m) "clear zone" triangle shall be included in the design of all intersection corners for sight distance purposes.



At intersections with county or state roadways, data shall be supplied to verify compliance with Case IV or V of 5-2.01, Intersection Sight Distance, Mn/DOT *Road Design Manual*. If the required sight distance onto the county or state roadway cannot be provided, then the intersection sight distance must be accomplished through regrading, intersection relocation, or turning movement restrictions.

Curb returns shall have a radius of 25' (7.6 m) measured to the back of curb. The top of curb elevation of each curb return shall be given on the plans at locations that differ from the typical section and at the point of curvature, point of tangency, and the midpoint of the curb return. These elevations should indicate how the cross sections of the intersecting streets are to be graded for proper drainage.

At the intersections the crown of the branch or lower volume street shall be broken and the cross slope warped to match the curb and gutter extension of the through or higher priority street beginning about 25' (7.6 m) from the PC of the curb return. The beginning of the crown transition should be shown on the plans. Simplified designs based only on intersection of centerlines are unacceptable.

#### **4.6 HORIZONTAL CURVES**

The minimum centerline radius for horizontal curves is 175' (55 m) and 275' (85 m) for local and collector streets, respectively. The minimum tangent length between horizontal curves is 50' (15 m) and 100' (30 m) on local and collector streets, respectively.

#### **4.7 PAVEMENT SECTION**

Local streets shall be 32' (9.8 m) from gutter line to gutter line. The city council may approve 28' (8.5 m) wide local streets in special cases when requested. Collector streets shall be either 34' (10.2 m) or 40' (12.0 m) wide. The 34' (10.2 m) wide collector shall be striped and signed for a 14' (4.2 m) wide travel lane with no parking, 12' (3.6 m) travel lane, and 8' (2.4 m) wide parking lane. A separate 5' (1.5 m) wide concrete sidewalk may be constructed with 34' (10.2 m) wide collectors. Alternatively, collectors may be 40' (12.0 m) wide with striping to provide a 6' (1.8 m) wide shoulder, two 12' (3.6 m) wide travel lanes, and a 10' (3.0 m) wide parking lane.

The typical local street section is shown in Maplewood Standard Plate 111. Collector streets shall be a minimum 9 ton (8.15 metric ton) design. County road restoration section is shown on Maplewood Standard Plate 114.

All aggregate base shall be compacted in accordance with Maplewood Specification MW-2211, Aggregate Base. The roll test prior to paving shall show **no** visible deflection.

In new developments where the wear course shall be laid the following year, the bituminous base course will serve as the temporary wear for that year. Its bitumen content shall be adjusted accordingly. The compaction sequence for both base and wear courses shall use vibratory steel wheel drum, pneumatic tire roller, and finally steel wheel drum. The bituminous wear course should be placed the year following bituminous base course placement.

For placement after October 20, concrete curb and gutter shall be protected from frost damage. Protection method shall be approved by the city engineer.

#### **4.8 STREET LIGHTING**

Maplewood rents streetlights from Xcel Energy. Streetlights are to be installed at each intersection or at other locations designated by the city engineer. The street light used by Maplewood is Xcel's decorative model. The street light installation costs are to be arranged and paid for by the developer with Xcel as part of the installation of the underground power distribution system by Xcel. All installed lighting shall be "Group V Rate" streetlights.

#### **4.9 STREET SAWING, STRIPING, AND SIGNING**

All new bituminous streets shall have sawed and sealed contraction joints in accordance with Maplewood Specification MW-2331A and Mn/DOT SP-5 2331. On streets shown in the developer's agreement or designated by the city engineer, the developer shall be responsible for interim and permanent striping and signing. This work is typically performed by city and/or county forces with all costs incurred paid for by the developer.

#### **4.10 TRAILS**

Where off-street trails are required, they shall meet the following criteria:

Vertical curves shall be based on a K of 18' (5.5 m). The minimum horizontal curve radius is 95' (29 m). The maximum desirable grade is 5%. The grade may be increased to 8% for short distances, where necessary.

The cross section of the trail shall be a minimum 8' (2.4 m) wide, 2" (50 mm) thick bituminous surface on 6" (150 mm) Class 6 aggregate base with a 2% cross slope. The aggregate base shall be a minimum 2 feet wider than the paved surface. See the typical trail section as shown in Maplewood Standard Plate 230.

**SECTION 5**  
**STORM SEWERS**

## SECTION 5 STORM SEWERS

### 5.1 REFERENCES

*Comprehensive Storm Water Management Plan for the City of Maplewood*, Orr-Schelen-Mayeron and Associates, Inc.

*Urban Hydrology for Small Watersheds*, Technical Release 55, Soil Conservation Service (TR-55)

*Protecting Water Quality in Urban Areas*, Best Management practices for Minnesota, Minnesota Pollution Control Agency

*Drainage Manual*, Minnesota Department of Transportation

*Watershed Management Plan*, Ramsey-Washington Metro Watershed District

*Minnesota Department of Transportation Standard Specification for Construction*, 2000 Edition

### 5.2 INLETS

Inlets are to be vane grates in the curb and gutter or area drains. Area drains shall have either flat radial grates or stool castings. Flat radial grates are to be used in areas that are paved or have maintained sod. Stool castings are to be used in low maintenance areas.

Catch basins shall be designed for the maximum inlet grate capacity during the 10-year design storm. The maximum spread of the drainage flow during the 10-year design storm shall be 8' (2.4 m) from the face of the curb. The potential for blow by of upstream catch basins shall be considered in the design of the total inlet capacity. Greater inlet capacity may be generated by ponding at low points. No increased allowances for inlet capacity will be made. Catch basins shall be designed to intercept gutter flow before it enters an intersection. Valley gutters are discouraged. Catch basins shall not be located in curb returns. Catch basins are typically located 5' (1.5 m) from the curb return point of curvature or point of tangency. Midblock catch basins shall be located on lot lines or other approved location to avoid conflict with potential driveways or trails.

A surface drain shall be located, where warranted, in a drainage easement where there is considerable runoff. A ditch block/berm shall be used to maximize the quantity of runoff into the surface drain. Overland drainage within a street section shall be limited to 500' (150 m) for each storm sewer inlet.

Generally, storm sewers are located under the east and south gutter lines. For maintenance access and to limit the length of gutter flow, catch basins/manholes shall be spaced at no greater than 400' (120 m) intervals.

Catch basins and/or manholes shall be a minimum 4' (1.2 m) diameter; 2' x 3' (0.6 m x 0.9 m) box catch basins are permitted on dead-end leads. Other than subsurface drains, only 1 pipe connection is recommended upstream of a box catch basin.

Frames shall be placed upon concrete sewer bricks, blocks or rings with mortar. Only undamaged concrete rings are acceptable. If any damaged rings are inadvertently used, the contractor shall be subject to removal and replacement at any time during the project as directed by the city engineer. High density polyethylene (HDPE) rings are **not** acceptable alternatives to concrete.

Mortar shall contain air-entrained hydrated lime to improve weatherability and bonding. The mortar between bricks, blocks, or rings shall be typically 3/8" (10 mm) thick. The interior face of mortar joint shall be tooled to limit water trapping and absorption. The bricks and frame shall accurately line up

with the structure opening within a tolerance of 0.1' (0.03 m). Placement of the frame and bricks in a corbel manner is unacceptable. The exterior of the bricks and frame shall be covered with 4" (100 mm) of concrete. Quality masonry construction is expected. Accurate placement of structures is required. See Maplewood Standard Plates 302 and 306 for horizontal tolerances.

Catch basin frames shall have a 0.1' (0.03 m) sump at low points only. Adjustments required to meet profile and cross section grades shall be accomplished by the frames being set with variable thickness of mortar and/or bricks. The use of nondeteriorating shims with subsequent placement of mortar is allowed. Nonshrink grout is required with said shims for setting the frame. Any cut pipe ends shall be coated with a 100% solid, two-part epoxy sealer to limit absorption of water.

**Considerable** care shall be taken to transition downstream flow lines back to catch basins **NOT** at low points to avoid gutter ponding.

The use of nonshrink grout is also required in the restoration of existing catch basins and manholes. The nonshrink grout shall be Grade A, prehardening, volume adjusting as outlined by Corps of Engineers CRD-C-621 and ASTM C1107.

### 5.3 LATERAL SYSTEM DESIGN

Storm sewers not conveying discharge from ponding areas are to be designed to carry the runoff from a 10-year storm. Pipes shall be designed to operate under open-channel conditions under the design storm. Mannings "n" of 0.013 shall be used.

Runoff rates are to be calculated by the rational method. A maximum time of concentration of 25 minutes shall be used. The "c" factor shall be a minimum of 0.4 for residential areas, 0.25 for park or open space, and 0.75 for commercial areas.

The typical minimum depth of cover of storm sewer pipes is 4' (1.2 m). The minimum pipe size is 12" (300 mm). On 12" (300 mm) and 15" (375 mm) pipe minimum grade is 0.5%. All pipe over 15" (375 mm) may use 0.3%. Energy losses in structures will be accounted for based on the following table:

MANHOLE ENERGY LOSS COEFFICIENTS*	
Type	K
Mini tee	0.0
Standard catch basin/manhole straight through	0.2
45° bend in catch basin/manhole	0.3
90° bend in catch basin/manhole	1.0
Tee run	0.6
Branch	1.0
Opposing tee (both legs)	1.6
Exit loss	1.0
* $\Delta E = K \frac{v^2}{2g}$	

The invert of flared ends discharging into ponding areas shall be at normal water elevation. The hydraulic grade line shall account for exit losses, including energy dissipaters, and the back pressure of the pond elevation during a storm event.

## **5.4 SUBSURFACE DRAINS**

Perforated PE drain tile with geotextile sock and fine filter aggregate (Mn/DOT Specifications 2502 and 3149J) shall be placed laterally across streets at low points and/or CB leads as well as longitudinally along the curb line, as required. See Maplewood Standard Plates 310 and 311 for placement details.

## **5.5 TRUNK SYSTEM DESIGN**

Storm sewers that carry discharge from ponding areas shall be designed based on SCS TR55 hydrography methodology. The city uses HydroCAD for modeling trunk storm sewers and ponding areas. The developer's engineer shall submit a map of the entire tributary with the limits of the various hydrologic soils classifications delineated. The maximum time of concentration for each subcatchment shall be 25 minutes plus the length of storm sewer to the farthest inlet divided by 3 ps (0.9 mps).

Modeling shall be done with an antecedent moisture condition of two. Generally, soils are Type B. In this case, the CN for residential areas shall be 72 (1/3-acre [0.13 ha] lots). Park or open space with Type B soils would be 61 (good condition grass). The design shall encompass the entire tributary area, not just the particular subdivision.

When a trunk storm sewer conveys a pond outlet plus direct runoff, it shall be designed for the maximum of two conditions. The first condition is the 10-year runoff for direct runoff areas, plus the capacity of the first stage outlet of the pond as a base flow. The capacity of the first stage is the flow rate when the pond level is just below the second stage outlet. If the pond only has a single outlet capable of conveying the 100-year event, then the base flow would be that resulting when pond level reaches the top of the outlet pipe.

The second condition is the 100-year event pond discharge alone. The maximum of these two conditions would be used as the design flow rate. This is intended to avoid both the overly conservative method of modeling pond outlet and direct runoff area with a 100-year event. The philosophy of these procedures for storm sewer design is not that they are theoretically correct in all cases. The intent is rather to produce a storm sewer system throughout the city that is consistent and reasonable.

## **5.6 STORM WATER PONDS**

To meet storm water runoff and water quality objectives, the use of on-site detention basins is required. On-site detention basins apply to project sites greater than 5 acres (2 ha). When wet detention basins are required, these basins must be designed to comply with the appropriate criteria of the basin type identified below for the development situation. If sites meet more than one site characteristic, the more restrictive requirement applies. The Ramsey-Washington Metro Watershed District staff will assist in determining site characteristics within said watershed.

BASIN TYPE	
Site Characteristics	Basin Design Required
All construction sites with greater than 5 acres (2 ha) of disturbance in one drainage area	Temporary dual purpose basin (TDPB)
Site drainage tributary to wetland on-site or immediately off-site wetland category: Least sensitive, highly impacted	None
Slightly sensitive, moderate to highly impacted, nonsignificant resource	Permanent dual purpose (PDPB) or wet detention basin (WDB)
Moderately sensitive, moderately impacted, nonsignificant resource	WDB
Highly sensitive, moderate to no impact, significant resource	WDB with restricted outlet
Site upstream of existing or proposed regional water quality basin of adequate size to meet drainage area needs.	None
Site upstream of existing or proposed water quality basin not adequately sized to meet drainage area needs.	PDPB or WDB
Site in drainage area without existing or proposed regional water quality basin.	PDPB or WDB
Site in drainage area where water quality and flood control are required, but land area is limited.	PDPB
Site upstream of adequate water quality basin, but 100-year storm event detention required.	Dry storm water detention basin (DSDB)

## 1. TEMPORARY AND PERMANENT DUAL PURPOSE BASIN

Designs shall be consistent with the most current version of the *Ramsey County Soil Erosion and Sediment Control Handbook*. A dual-purpose basin does not have a permanent standing pool of water. In a dual purpose basin, the outlet structure is modified to pool 100% of the 1-year, 1-hour rainfall runoff from the drainage area and allows it to slowly flow from the basin through a granular filter and/or perforated riser outlet structure. PDPBs must provide at least a 1' (0.3 m) deep zone along the base of basin for accumulated sediments. The outlet structure for both permanent and temporary basins must include an overflow structure to allow excess flows from larger storm events to leave the basin. The required 1-year and 100-year storm event storage is provided above the 1' (0.3 m) deep sediment storage zone. Permanent basin requirements are:

### a. Long-Term Suspended Solids Removal Efficiency

Total suspended solids (TSS) removal of 80%. Total phosphorus (TP) removal of 60%.

b. **Peak Discharge Rate**

Shall not exceed the predevelopment peak rate of runoff or the rate as defined in this plan for all critical duration events up to and including the 100-year event.

c. **Routing Procedures**

Reservoir routing procedures and critical storm events shall be used for design of detention basins and outlets.

d. **Pond Shape**

Maximize length/width ratio. Prevent short-circuiting and minimize potential of resuspension of sediments.

e. **Slopes**

Above normal water level (NWL) slopes 3:1 or flatter. Pond shelf width of 10' (3.0 m), 1' (0.3 m) below NWL. Other slopes in pond 4:1 or flatter.

f. **Inlet/Outlet**

Inlets at or below NWL. Emergency spillway for storms over 100-year event. One 100-year storm event to be handled by the pond outlet without using the emergency spillway. Energy dissipation to be provided at inlets and outlets. Outlet structure design must:

- (1) Incorporate facilities that will remove floating debris from the existing water.
- (2) Provide for adequate access for maintenance and repairs.

g. **Other**

Maintain site access for pond maintenance. Provide draw-down device to drain the permanent pool. For smaller basins a portable pump may be used as the draw-down device. Plant native aquatic vegetation over shelf area. Basin upland buffer should be planted with native water-tolerant grasses, shrubs, and trees. If a temporary dualpurpose basin is to be converted to the permanent dual- purpose basin, the pond shall be excavated to provide the required volumes at the prescribed levels in the most current version of the *Ramsey County Soil Erosion and Sediment Control Handbook* manual, following stabilization of the site and prior to final landscaping.

h. **Maintenance**

Sediment basins should be excavated to original design configuration when storage capacity is reduced by more than 10%.

2. **WET DETENTION WATER QUALITY BASIN (WDB):**

The following requirements shall apply:

a. **Long-Term Phosphorus and Suspended Solids Removal Efficiency**

Total phosphorus (TP) removal of 60% and total suspended solids (TSS) removal of 85%.

b. **Peak Discharge Rate**

Shall be controlled to restrict flows to ensure the required treatment is achieved.



c. **Routing Procedures**

Reservoir routing procedures and critical storm events shall be used for design of detention basins and outlets.

d. **Pond NWL Surface Area**

At least 0.5% of the total watershed. If runoff from part of the watershed is being effectively treated by an upstream basin, that part of the watershed may be excluded from the basin-sizing requirement.

e. **Pond Depth**

Average at least 4' (1.2 m). Maximum depth less than 10' (3.0 m) unless fish habitat is part of the design.

f. **Pond Volume**

Dead storage at least 0.5" (13 mm) of runoff from the entire drainage area (0.4" [10 mm] for water quality treatment and an additional 25% or 0.1" [3 mm] for sediment storage).

g. **Pond Shape**

Maximize length/width ratio. Prevent short-circuiting and minimize potential of resuspension of sediments.

h. **Slopes**

Above NWL slopes 3:1 or flatter. Pond shelf width of 10' (3.0 m), 1' (0.3 m) below NWL. Other slopes in pond 4:1 or flatter.

i. **Inlet/Outlet**

Inlets at or below NWL. Emergency spillway for storms over 100-year event. Onehundred year storm event to be handled by the pond outlet without using the emergency spillway. Energy dissipation to be provided at inlets and outlets. Outlet structure designs must:

- (1) Incorporate facilities that will remove floating debris from the existing water.
- (2) Provide for adequate access for maintenance and repairs.

i. **Other**

Maintain site access for pond maintenance. Provide draw-down device to drain the permanent pool. For smaller basins a portable pump may be used as the draw-down device. Plant native aquatic vegetation over shelf area. Basin upland buffer should be planted with native water tolerant grasses, shrubs, and trees. If the temporary sediment basin is to be converted to the permanent basin, the pond shall be excavated to the original planned contours following stabilization of the site and prior to final landscaping.

j. **Maintenance**

Water quality basins should be excavated to original design configuration when storage capacity is reduced by more than 25%.

### 3. **WET DETENTION WATER QUALITY BASIN (WDB) WITH RESTRICTED OUTLET**

The standards for wet detention water quality basins apply to this basin type with the addition of provisions to further limit the total peak-rate water volume discharged from the basin. The peak rate of discharge shall not exceed the predevelopment peak runoff rate for the tributary watershed or the peak rate defined in the comprehensive storm water plan for all critical events up to and including the 100-year event. In some cases this may be accomplished by allowing only a portion of the new storm water volume to discharge to the basin and diverting the remainder of the flow around the wetland basin. Limitation of the drainage volume can also be accomplished through redesign of the project site drainage areas. Care must be given to assure continued hydrology for the natural wetland basin. Therefore, care must be given to the location and type of flow distribution to the natural wetland after development of the site.

### 4. **DRY STORM WATER DETENTION BASIN**

Dry detention basins are designed strictly for flood (water quantity) control. Water quality is not a consideration in the design. The peak discharge rate must not exceed the peak rate defined in the comprehensive storm water plan for the critical 100-year event. Basin slopes shall be 3:1 or flatter.

A summary of the comprehensive storm water plan pond volume and peak flow rate values is available when requested. The engineering department maintains a current version of the HydroCAD model for the city. The model is updated as development or improvements occur. Therefore, it is important to confirm allowable flow rates before designing a ponding system. Complete records of the design parameters must be provided so that the model can be maintained. The design stage-storage relationship must be verified through a survey at the completion of construction.

Ponding easement or fee title ownership of ponding areas shall be provided to the city. The limits of easement shall include 2 vertical feet (0.6 m) of freeboard above the 100-year-high water level. The 100-year high water level shall be determined by SCS methodology (either TR55 or HydroCAD). A 5.9" (150 mm), 24-hour, Type II distribution rainfall event shall be used. The antecedent moisture condition shall be 2. The entire tributary area shall be included in the calculations. The CN values shall be based on ultimate development as given in the city's land use plan.

The entire perimeter of the fee title pond or easement, 10 acres (4 ha) in area or less, shall be fenced unless it meets the criteria stated below. The fence shall be minimum 5' (1.5 m) high vinylclad, chain-link conforming to Mn/DOT Design 60-9322 Type IV. At least one double vehicular gate shall be provided for access near the pond inlet. A 15' (4.6 m) wide maintenance access shall be benched into the pond side slope near the vehicular gate.

If there is sufficient area available, it is desirable to grade the entire perimeter of the pond and eliminate fencing. No fence is required if the entire wet bench (area between normal and high water levels) perimeter is graded to ten horizontal and one vertical (10:1).

Appropriate native vegetation, trees and shrubs shall be incorporated into the pond landscape design.

## 5.7 **ENERGY DISSIPATERS**

Energy dissipaters are any devices designed to protect downstream areas from erosion by reducing the velocity of flow to acceptable limits. The culvert exit velocity should be consistent with the riprap design and maximum velocity in the natural channel or should be mitigated. The dissipater type selected for a site must be appropriate to the location. An external dissipater is located outside of the culvert and an internal dissipater is located within the culvert barrel.

## 1. DISSIPATER TYPE SELECTION

### a. Internal Dissipater

- (1) Right of way/easement is limited
- (2) Debris is not a problem
- (3) Moderate velocity reduction is needed
- (4) External dissipater is unacceptable

### b. Natural Ponding Area

- (1) Undermining of the culvert outlet will not occur
- (2) The expected ponding will not cause costly property damage
- (3) There is no nuisance effect

### c. External Dissipater

- (1) The natural ponding area is not acceptable
- (2) Moderate amount of debris is present
- (3) The culvert outlet velocity is moderate

### d. Stilling Basin

- (1) The natural ponding area is not acceptable
- (2) Debris is present
- (3) The culvert outlet velocity is high

### e. Ice Buildup

- (1) Size the structure to not obstruct the winter low flow
- (2) Use external dissipaters

The material selected for the dissipater should be based on a comparison of the total cost over the design life of alternate materials. Consideration should be given to maintenance requirements, aesthetics, and other items that may be pertinent to the site. Traffic should be protected from external energy dissipaters by separation distance or traffic barriers.

The culvert should be designed independent of the dissipater design with the exception of internal dissipaters. The culvert design should be completed before the outlet protection is designed and should include computation of outlet velocity.

## 2. RIPRAP

At culvert outlets where riprap will be used the size of the riprap diameter (d) shall be as follows (Mn/DOT 3601.2A2a):

### a. Rate of Discharge (Q):

- (1)  $Q < 6$  cfs (0.17cms) - then sod or seed w/fiber blanket
- (2)  $6 \text{ cfs (0.17 cms)} < Q < 8 \text{ cfs (0.23 cms)}$  - then sod or seed with polypropylene netting
- (3)  $8 \text{ cfs (0.23 cms)} < Q < 11 \text{ cfs (0.31 cms)}$  - then D = Class III riprap
- (4)  $11 \text{ cfs (0.31 cms)} < Q < 13 \text{ cfs (0.37 cms)}$  - then D = Class IV riprap
- (5)  $13 \text{ cfs (0.37 cms)} < Q$  - then special design

Classes II and V riprap should not be used

**b. Riprap Basin Design**

- (1) Preshape and line with properly sized riprap (D)
- (2) Construct the floor at a depth (h) below the invert that is the depth of scour that would occur in a pad of the sized riprap (D)
- (3) Size riprap so that  $2 < h/D < 4$
- (4) Either angular or rounded riprap is acceptable.
- (5) Size the length of the dissipating pool to be 10 times the depth (h) or 3 times the culvert diameter, whichever is larger.
- (6) The width of the basin floor should increase with the length of the basin at a 1 to 3, width to length, ratio.
- (7) Size the length of the apron to be 3 times the depth (h) or equal to the culvert diameter, whichever is larger.
- (8) The thickness of the riprap shall be 1.5 times the maximum size (d)
- (9) The transitional slopes between the floor of the basin and the culvert outlet, apron, and the top of the riprap berm shall be a maximum of 2:1.

**SECTION 6**  
**SANITARY SEWER**

## **SECTION 6 SANITARY SEWER**

### **6.1 REFERENCES**

*Standard Utilities Specifications*, City Engineers' Association of Minnesota, latest edition.

*Recommended Standards for Sewage Works*, The Committee of the Great Lakes/Upper Mississippi River Board of State Sanitary Engineers ("Ten States" standards)

*Minnesota Plumbing Code, Chapter 4715*, Department of Health, State of Minnesota

*Minnesota Department of Transportation Standard Specifications for Construction*, 2000 Edition

*Maplewood Specifications* (MW)

### **6.2 SEWER MAIN LOCATION**

The design of sanitary sewer shall be in accordance with the referenced standards and as modified herein.

Manholes shall typically be located on the street centerline. On curvilinear streets, the chord between manholes can deviate from street center line by a maximum of 10' (3.0 m) on the east and south side and 5' (1.5 m) on the west and north sides (water main locations).

Where it is necessary to run a sanitary sewer through an easement, the easement shall typically be a straight line from right-of-way to right-of-way. There shall be no manholes located in an easement unless the length exceeds 400' (120 m) or a bend in the alignment is required.

Sanitary sewer should typically be at a minimum depth of 10' (3.0 m). It shall be designed to allow extension to adjacent subdivisions to be developed within the sanitary sewer service area. In certain cases it may be necessary to build shallower sewers. The minimum depth of cover for main or service without insulation is 6' (1.8 m). Four-feet (1.2 m) wide, 2" (50 mm) thick high-density insulation as shown in Maplewood Standard Plate 530 is required for depth of cover of main or service between 5' (1.5 m) and 6' (1.8 m). Construction of sanitary sewer main or service at less than 5' (1.5 m) of cover is not permitted.

### **6.3 SERVICES**

Services shall be extended to the right-of-way or platted front utility easement line for all potential lots. The construction of wyes only is not permitted. The depth of each service shall typically be 10' (3.0 m) at the right-of-way line. It is recommended that the service be extended an additional 10' (3.0 m) beyond the right-of-way line to facilitate extension to the building. Service shall be located in the middle of the lot to avoid placement under the driveway.

No service may be directly connected to a manhole.

Services more than 100' (30 m) from the main to the building shall be provided with a clean out near the right-of-way line, in accordance with Maplewood Special Plate 414.

### **6.4 MATERIALS**

Sanitary sewer main shall be PVC, SDR 35, with push-on joints for depths of cover up to 20' (6.1 m). Ductile iron pipe, Class 52, shall be used for main in excess of 20' (6.1 m) of cover. Manhole invert elevation differences are limited to 2' (0.6 m). Where elevation differences exceed 2' (0.6 m), an outside drop structure conforming to Maplewood Standard Plate 401 shall be constructed.

All sanitary sewer main and services shall be bedded and backfilled as shown in Maplewood Standard Plate 440. Granular bedding shall conform to Mn/DOT Specification 3149.2F. Backfill material shall be in accordance with Maplewood Specification MW-2451. If it is desired to use on-site material for pipe bedding, it shall conform to Mn/DOT Specification 3149.2F.

Services shall be PVC, Schedule 40, with solvent weld (two-step) joints. The wye shall be Schedule 40 or a PVC fitting shall be attached to the wye to transition from SDR 35 main to Schedule 40 service pipe. The use of a Fernco connecting adapter for this purpose is not allowed. DIP, Class 53, shall be used for 4" and 6" services exceeding 20' (6.1 m) of cover.

Clean outs shall be PVC, Schedule 40, wye, and riser, with a magnetic or metal cap. The cap shall be just below the finished sod. Reference Maplewood Special Plate 414.

Sewer services, which are so shallow that they are undermined by water main or storm sewer, shall be of DIP, Class 53 from the main to the right-of-way. Sewer service materials shall be compatible with the sewer main.

## **6.5 PRIVATE SYSTEMS**

As a minimum, each building shall be provided with a separate sewer service. Twin or multiple homes, where there is a zero clearance lot line between the residences, shall be treated as two separate buildings. Each side shall have a separate service. The standards of the *Minnesota Plumbing Code* apply to each building and its service until the service joins with that from another building. Downstream pipe is considered sewer main.

Private sewer mains may be extended within a parcel under single ownership to serve multiple buildings. Private mains shall meet the same material and construction specifications as public mains. Manholes shall typically be located in paved areas.

**SECTION 7**  
**WATER SYSTEMS**



## **SECTION 7 WATER SYSTEMS**

### **7.1 REFERENCES**

*Maplewood Specifications (MW)*

*Engineering Guidelines for Water Main, City of North St. Paul*

*Standards for the Installation of Water Mains, St. Paul Regional Water Services.*

*Standard Utilities Specifications, City Engineers' Association of Minnesota.*

*Thrust Restraint Design for Ductile Iron Pipe, Ductile Iron Pipe Research Association.*

*Recommended Standards for Water Works, The Committee of the Great Lakes/Upper Mississippi Board of State Sanitary Engineers ("Ten State" Standards).*

### **7.2 ST. PAUL REGIONAL WATER SERVICES**

All water main improvements to be constructed within the St. Paul Regional Water Services service area after January 1, 1997, will be approved by the St. Paul Regional Water Services. Inspection shall be performed by the SPRWS and the engineer representing the city or owner (private developer).

#### **1. DEFINITIONS**

Reference SPRWS standards, Division 1000

#### **2. ENGINEERING DESIGN STANDARDS**

Reference SPRWS standards, Division 2000

#### **3. MATERIALS**

Reference SPRWS standards, Division 3000

#### **4. INSTALLATION OF PIPE AND APPURTENANCES**

Reference SPRWS standards, Division 4000

#### **5. TESTING OF PIPE, SERVICE CONNECTIONS, AND APPURTENANCES**

Reference SPRWS standards, Division 5000

### **7.3 OTHER WATER SYSTEMS**

Portions of Maplewood are serviced by North St. Paul, Woodbury, Oakdale, Little Canada, and Roseville water mains. Reference the North St. Paul *Engineering Guidelines for Water Main* for water main design in that city. Any difference in materials and construction requirements from the SPRWS standards can be found in Maplewood Specification MW-2504.